DEAD CREEK
SOIL-GROUNDWATER LEACHING INVESTIGATION

SAUGET AREA 1
SAUGET AND CAHOKIA, ILLINOIS

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1.0 INTRODUCTION

This report summarizes the Dead Creek Soil to Groundwater Leaching Investigation activities performed at the Sauget Area 1 site in Sauget, Illinois during July 2007. The work was performed in accordance with the Sauget Area 1 – Revised Sampling Plan for Dead Creek Soil-Groundwater Leaching Investigation Work Plan dated April 27, 2007. This plan was approved by the U.S. Environmental Protection Agency (USEPA) on May 24, 2007. Any deviations from the Work Plan are identified and discussed in the report.

Groundwater samples were collected on July 10 and 11, 2007 from four temporary wells installed in each of Creek Segments C, D, E, and F. The temporary wells were located downgradient of the location of the transect in each creek segment where the highest concentration of cadmium was detected during sampling performed in 2002 immediately following removal of the creek bottom sediments (Figures 1 and 2). The temporary wells were installed on July 9, 2007 and were subsequently removed following sampling. This report summarizes the work performed during the investigation.

2.0 GROUNDWATER SAMPLING ACTIVITIES

2.1 Soil Borings

Roberts Environmental Drilling Inc. (REDI) advanced four boreholes and installed temporary wells at four locations west of Dead Creek on July 9, 2007, under the direct supervision of Golder Associates Inc. (Golder). The field work was also observed on a full time basis by a representative of CH2M Hill, the USEPA oversight contractor.

The boreholes were advanced at the following locations:

- Transect-T7 at Dead Creek Segment C (CSC-T7), temporary well 7
- Transect-T2 at Dead Creek Segment D (CSD-T2), temporary well 2
- Transect-T16 at Dead Creek Segment E (CSE-T16), temporary well 16
- Transect-T6 at Dead Creek Segment F (CSF-T6), temporary well 6

The four soil borings were advanced using direct-push technology (DPT) with a Geoprobe® 6610 series track-mounted rig. Samples were collected for lithologic logging as the boreholes were advanced with 2-inch macrocore sample barrels. The boreholes were advanced until groundwater was encountered as indicated in the soil samples and were terminated approximately five feet below the water table.

Soil samples were continuously collected in 4-foot intervals and classified by Golder personnel according to the Unified Soil Classification System (USCS). All soil from each borehole was collected in 5-gallon plastic buckets and was transferred to a labeled 55-gallon drum located at the Judith Lane facility.

2.2 Temporary Well Installation

A temporary well was installed at each boring location. Installation consisted of placing a five-foot long, ¾-inch diameter, flush-threaded 0.010-inch slotted schedule 40 PVC pre-packed well screen through the Geoprobe® rods. The screen was pushed to a depth of at least five feet below the groundwater table and the rods were slowly withdrawn from the borehole to expose the screen to the groundwater. In order to reduce the turbidity of the samples, silica sand was poured to a depth approximately two feet above the top of the well screen to create a filter pack and bentonite pellets were then placed to the ground surface. A riser pipe constructed of ¾-inch diameter schedule 40 PVC extended the temporary wells above ground surface.

Temporary well T6 was offset approximately 150 feet west of CSF-T6 due to inaccessibility issues caused by dense woods and underbrush. Temporary well T16 was offset approximately 50 feet west of CSE-T16 because an apartment complex is located on the edge of Dead Creek and there is no room for drilling equipment between the structure and the creek at the location of Transect T16. The CH2M Hill representative was present when these locations were selected and accepted the need to offset them from the creek bank. The other two temporary wells were located on the crest of the bank, approximately one to five feet from the edge of the bank. The locations of the temporary wells are shown on Figures 1 and 2.

2.3 Groundwater Sampling

Golder conducted groundwater sampling at the four temporary wells on July 10 and 11, 2007. A total of twelve (12) groundwater samples were collected immediately below the water table through dedicated polyethylene tubing using a low flow, peristaltic pump. The wells were purged and water quality parameters (pH, temperature, specific conductivity, and turbidity) were measured and recorded during purging. Purging continued until all the parameters had stabilized for three consecutive readings and the turbidity was approximately 10 NTUs or lower.

Both filtered and unfiltered samples were collected for cadmium analyses. Two filtered samples were collected at each sampling location. One sample was passed through a 10 micron filter, while the other was passed through a 0.45 micron filter. This allowed the measurement of total cadmium concentrations (unfiltered samples), as well as the colloidal (10-micron filtered samples) and dissolved (0.45-micron filtered samples) concentrations. All the filtration was done using in-line filters to avoid exposure of the samples to air. Groundwater samples were preserved on ice and sent to Test America in Savannah, Georgia for analysis (formerly Savannah Laboratories).

All samples were collected and analyzed using the methods, procedures and protocols included in the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan, Field Sampling Plan and Quality Assurance Project Plan approved by the USEPA on September 9, 1999. The groundwater samples were analyzed for cadmium using USEPA SW-846 Method 3550/6020.

Purge water collected during sampling from each borehole was stored in 5-gallon plastic buckets and transferred to a labeled 55-gallon drum located at the Judith Lane facility.

2.4 Temporary Well Abandonment

Following sampling of the four temporary wells, removal of the riser pipe and screen, as required by the approved Work Plan, proved unsuccessful in three of the four installations due to the settling of the bentonite pellets and sand around the screen and riser pipe. The uppermost section of the riser pipe from T6, T2 and T16 was removed and the remainder of the hole was filled with hydrated bentonite pellets. The pre-packed screen in temporary well T7 was removed and the borehole was filled with bentonite pellets. Final abandonment of T16 consisted of an asphalt patch to match the existing asphalt in the parking lot. All personal protective equipment and expendable well materials that were accumulated throughout the investigation activities were transferred to a labeled 55-gallon drum at the Judith Lane facility.

3.0 GROUNDWATER SAMPLING RESULTS

3.1 Data Validation Results

As mentioned, twelve (12) samples were collected using a low flow, peristaltic pump. Two field duplicates were also collected, as was a matrix spike/matrix spike duplicate (MS/MSD) which was collected with sample MW-T16-UNF. Samples were analyzed for cadmium, using the methods, procedure, and protocols included in the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan, Field Sampling Plan and Quality Assurance Project Plan approved by USEPA on September 9, 1999.

Data validation was performed following the general guidelines of Section 9.2 of the "Quality Assurance Project Plan, Sauget Area 1 Support Sampling Project, Sauget and Cahokia, Illinois, Volume 2". A summary of the validated analytical results is included in Table 1, and laboratory analytical reports are attached as Appendix B. Data validation reports are attached as Appendix C.

There was one minor concern about some of the samples that required qualification of the results because the serial dilution was not within a 10% difference (%D) of the original determination after correction for dilution. Requirements for acceptable instrument calibration are established to ensure the instrument is capable of generating satisfactory data. The USEPA functional guidelines for data evaluation require that if the analyte concentration is sufficiently high (50 times the Method Detection Limit (MDL)), the serial dilution analysis should be within 10% of the original determination after correction for dilution. In accordance with the functional guidelines, results that were greater than, or equal to the MDL, were qualified as estimated values (J) and non-detects were also qualified as estimated values (UJ). Samples MW-T2-UNF, MW-T2-10, MW-T2-0.45 were qualified with J flags, while samples MW-T6-10 and MW-T6-0.45 were qualified with UJ flags, based on a review of serial dilution. No data were rejected.

Where a positive result was qualified as estimated, the analyte should be considered present. Similarly, a detected or non-detected result, which was qualified as an estimated reporting limit, should be considered not present for the purposes of this program, although the limit itself may not be precise. The completeness for the entire data set was 100%.

3.2 Discussion of Results

Groundwater sample results for each temporary well are presented below for the filtered and unfiltered fractions along with the temporary well location and the cadmium concentrations in soil samples obtained in 2002 (2002 soil samples collected from soil remaining in Dead Creek following the removal action):

Creek Segment and Sample ID	Location	2002 Concentration (mg/kg)	Unfiltered Conc. (mg/L)	Filtered Conc. (10 µm) (mg/L)	Filtered Conc. (0.45µm) (mg/L)
C-MW-T7	**Approx. one foot from bank at T-7**	**25 J**	**0.00024 J**	**0.00016 J**	**0.00017 J**
D-MW-T2	**Approx. one foot from bank at T-2**	**40 J**	**0.00056 J**	**0.00051 J**	**0.00058 J**
E-MW-T16	**50 ft. west of bank at T-16**	**38 J**	**0.00013 J**	**0.00014 J**	0.00050 U
F-MW-T6	**150 ft. west of bank at T-6**	**70**	**0.00015 J**	0.00050 UJ	0.00050 UJ

J - Denotes an estimated concentration
U - Compound not detected
Bold text denotes compound detected at a concentration in excess of the detection limit

Examination of the results in the preceding table shows that there is no significant difference between filtered and unfiltered cadmium concentrations in any of the samples. In each of the samples, the detections in each fraction (unfiltered, colloidal, and dissolved) were within 0.0001 mg/L of other samples from the same well. Results for each individual monitoring well are discussed below:

- In MW-T7 (Creek Segment C), cadmium was detected in all three samples. Cadmium concentrations in the unfiltered sample were greatest (0.00024 mg/L) and were similar in the filtered samples (0.00016 and 0.00017 mg/L, respectively). The very small differences in the concentrations in the three sample fractions make meaningful comparisons difficult.

- In MW-T2 (Creek Segment D), cadmium concentrations were also similar in all three samples. Based on these results, it appears that the cadmium in these samples was primarily dissolved in groundwater.

- In MW-T16 (Creek Segment E), cadmium concentrations were similar in the unfiltered and colloidal fractions, but was not detected in the dissolved phase. These results demonstrate that cadmium is primarily associated with colloidal sized material at this location.

- In MW-T6 (Creek Segment F), cadmium was only detected in the unfiltered sample, indicating that it was associated with particulate matter suspended in the sample and is not mobile in the groundwater.

The other point to be noted about the results summarized in the table is that the cadmium concentrations in samples from all of the wells are very similar, with the sample concentrations in well MW-T2 being marginally higher than the others. Given these similarities, it is reasonable to expect that the results obtained from the wells in Creek Sectors E and F are representative of conditions immediately downgradient of the creek, despite the fact that these wells were not immediately adjacent to the creek.

Transects with the highest cadmium concentrations in soil were selected in each creek segment for the leaching to groundwater investigation. Since all groundwater results (both filtered and unfiltered) were below the Illinois Class I groundwater protection standard of 0.005 mg/L, the results of this investigation demonstrate that cadmium leaching from soils in the creek bottom does not present an issue for shallow groundwater quality. The cadmium concentrations detected in all groundwater samples (both filtered and unfiltered fractions) were all less than 0.001 mg/L and three of the four temporary wells contained cadmium at concentrations that are less than five percent of the Illinois Class I groundwater protection standard of 0.005 mg/L. As explained in the USEPA-approved Sampling Plan for the Investigation, in creek Sectors C through F, constituents other than cadmium were demonstrated to not be of concern for leaching to groundwater based on concentrations remaining in creek bottom soils. This investigation has demonstrated that, in addition, cadmium is not of concern for leaching to groundwater.

4.0 SIGNATURES

Please contact us if you have any questions regarding this work or require additional information.

Sincerely,

GOLDER ASSOCIATES INC.

-signature in original hard copy-

Amanda W. Gilbertson, Ph.D.
Staff Environmental Engineer

-signature in original hard copy-

Mike S. Lemon, P.E., R.G.
Project Engineer

-signature in original hard copy-

Frederick M. Booth, P.G.
Senior Consultant, Principal

TABLES

Table 1

Summary of Validated Groundwater Sample Detections - Inorganics (July 2007 Sampling Event)
Dead Creek Soil-Groundwater Leaching Investigation
Sauget Area 1
Solutia, Inc. - Sauget, Illinois

Monitoring Well		MW-T2-UNF	MDL	MW-T2-10	MDL	MW-T2-0.45	MDL	MW-T6-UNF	MDL	MW-T6-10	MDL	MW-T6-0.45	MDL
Lab Sample ID		680-28339-7		680-28339-8		680-28339-9		680-28339-11		680-28339-12		680-28339-13	
Date Sampled		7/11/2007		7/11/2007		7/11/2007		7/11/2007		7/11/2007		7/11/2007	
Time Sampled		11:25		11:30		11:35		15:10		15:15		15:20	
Metals (USEPA Method 6020)													
Date Prepared		7/19/2007		7/19/2007		7/19/2007		7/19/2007		7/19/2007		7/19/2007	
Date Analyzed		7/21/2007		7/21/2007		7/21/2007		7/21/2007		7/21/2007		7/21/2007	
Analyte	**CAS No.**	**(mg/L)**		**(mg/L)**		**(mg/L)**		**(mg/L)**		**(mg/L)**		**(mg/L)**	
Cadmium	7440-43-9	***0.00056 J***	0.00012	***0.00051 J***	0.00012	***0.00058 J***	0.00012	***0.00015 J***	0.00012	0.00050 UJ	0.00012	0.00050 UJ	0.00012

Parameters not listed were not detected in any samples.
Results in ***bold italics*** denote detections.
mg/L - milligrams per Liter
MDL - Method Detection Limit

Flags and Qualifiers
U - Analyte was not detected at or
above the Method Detection Limit (MDL).
J - Result is an estimated value.
The concentration is an approximate value.

Checked by: JAP Date: 8/30/07
Reviewed by: AWG Date: 8/31/07

Table 1
Summary of Validated Groundwater Sample Detections - Inorganics (July 2007 Sampling Event)
Dead Creek Soil-Groundwater Leaching Investigation
Sauget Area 1
Solutia, Inc. - Sauget, Illinois

Monitoring Well		MW-T7-UNF	MDL	MW-T7-10	MDL	MW-T7-0.45	MDL	MW-T16-UNF	MDL	MW-T16-10	MDL	MW-T16-0.45	MDL
Lab Sample ID		680-28339-1		680-28339-2		680-28339-3		680-28339-4		680-28339-5		680-28339-6	
Date Sampled		7/10/2007		7/10/2007		7/10/2007		7/11/2007		7/11/2007		7/11/2007	
Time Sampled		12:50		12:55		13:00		9:20		9:25		9:30	
Metals (USEPA Method 6020)													
Date Prepared		7/19/2007		7/19/2007		7/19/2007		7/19/2007		7/19/2007		7/19/2007	
Date Analyzed		7/21/2007		7/21/2007		7/21/2007		7/21/2007		7/21/2007		7/21/2007	
Analyte	**CAS No.**	**(mg/L)**		**(mg/L)**		**(mg/L)**		**(mg/L)**		**(mg/L)**		**(mg/L)**	
Cadmium	7440-43-9	***0.00024 J***	0.00012	***0.00016 J***	0.00012	***0.00017 J***	0.00012	***0.00013 J***	0.00012	***0.00014 J***	0.00012	0.00050 U	0.00012

Parameters not listed were not detected in any samples.
Results in ***bold italics*** denote detections.
mg/L - milligrams per Liter
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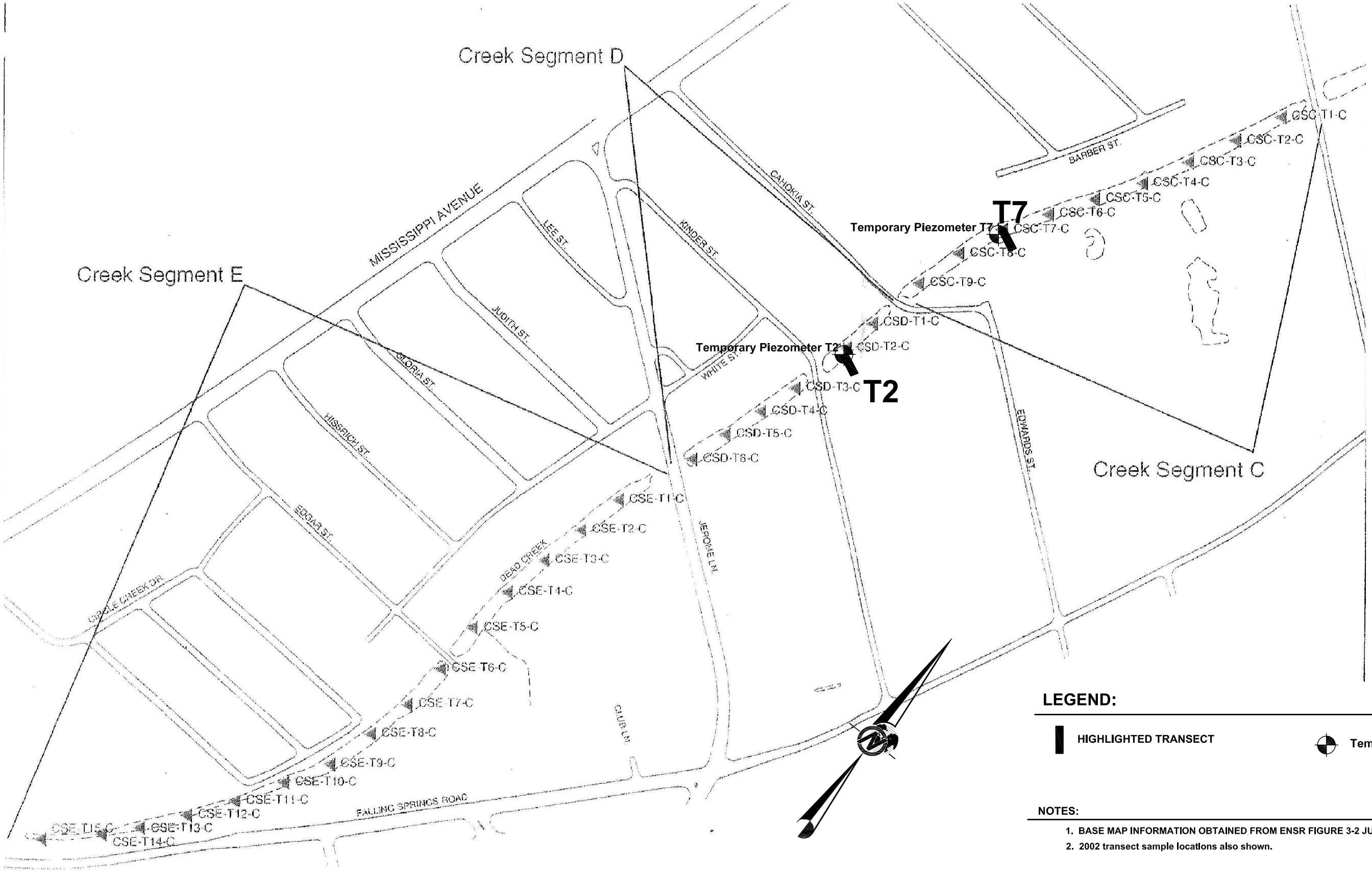
Checked by: JAP Date: 8/30/07
Reviewed by: AWG Date: 8/31/07

FIGURES



LEGEND:

- HIGHLIGHTED TRANSECT
- Temporary Piezometer

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM ENSR FIGURE 3-2 JUNE 21, 2002.
2. 2002 transect sample locations also shown.

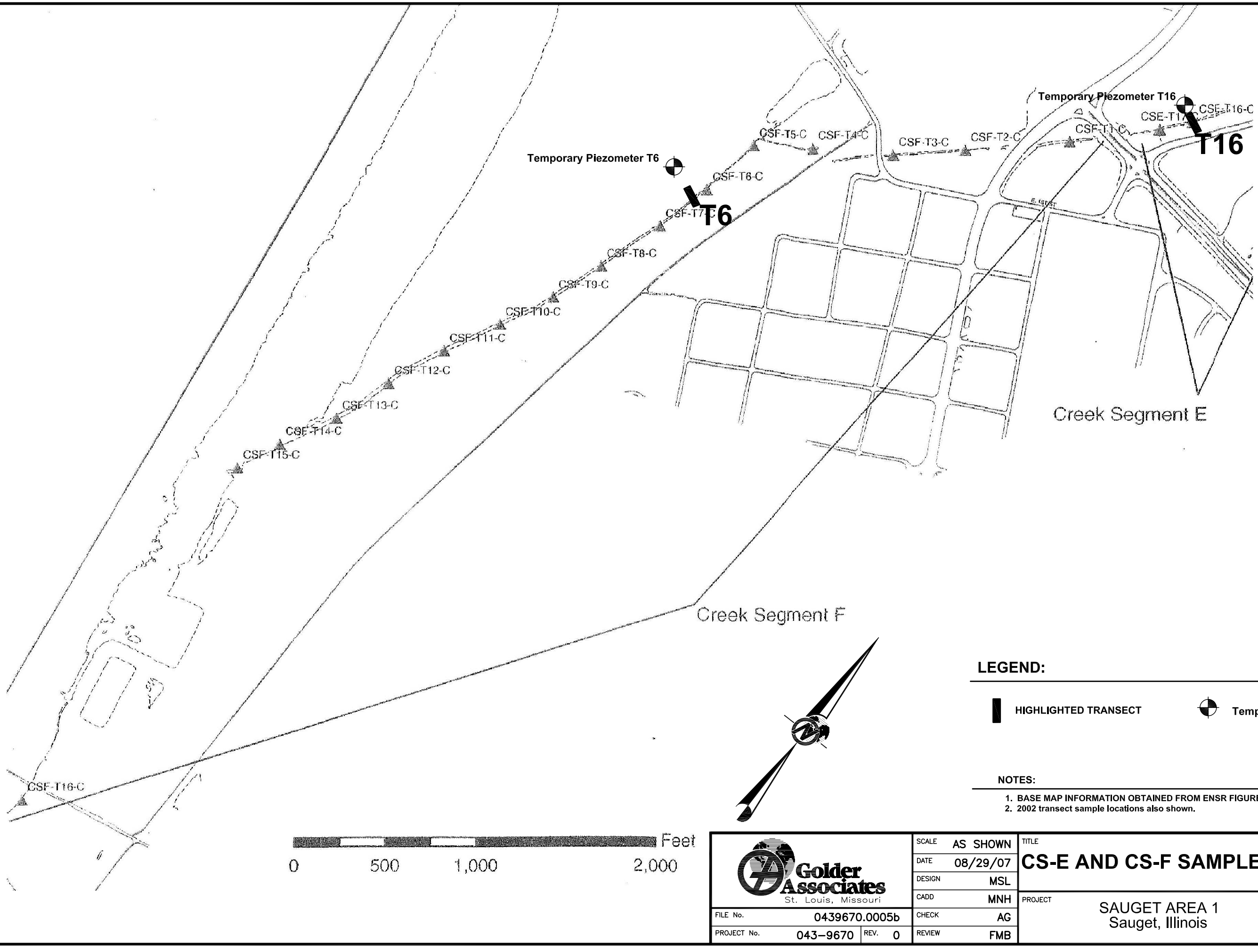
Golder Associates
St. Louis, Missouri

FILE No.	0439670.0005a
PROJECT No.	043–9670
REV.	0
SCALE	AS SHOWN
DATE	08/29/07
DESIGN	JAP
CADD	MNH
CHECK	AG
REVIEW	FMB

TITLE: **CS-C AND CS-D SAMPLE LOCATIONS**

PROJECT: SAUGET AREA 1
Sauget, Illinois

FIGURE: 1



LEGEND:

- HIGHLIGHTED TRANSECT
- Temporary Piezometer

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM ENSR FIGURE 3-3 JUNE 21, 2002.
2. 2002 transect sample locations also shown.

Golder Associates
St. Louis, Missouri

FILE No.	0439670.0005b
PROJECT No.	043–9670
REV.	0
SCALE	AS SHOWN
DATE	08/29/07
DESIGN	MSL
CADD	MNH
CHECK	AG
REVIEW	FMB

TITLE
CS-E AND CS-F SAMPLE LOCATIONS

PROJECT
SAUGET AREA 1
Sauget, Illinois

FIGURE
2

APPENDICES